

Improved access to temporary pacing in Denmark

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ABSTRACT

INTRODUCTION: The aim was to illustrate current use of temporary pacing (TP) in Denmark by replicating a questionnaire study from 1986 and to compare the results of the two studies.

MATERIAL AND METHODS: The questionnaire was sent to Danish hospitals treating patients with acute myocardial infarction (AMI). To illustrate potential changes in the indications for TP, the questionnaire included two case reports also used in 1986.

RESULTS: Thirty-three of 39 hospitals returned the questionnaire. Thirty-one (94%) were able to perform transcutaneous TP, and 20 (61%) had access to transvenous TP. Transcutaneous TP was preferred in five hospitals, and transvenous TP was the procedure of choice in 15. In 1986, 13 of 74 (18%) hospitals were able to perform transcutaneous TP, and 33 of 74 (45%) had access to transvenous TP. Over the two decades, the proportion of patients with AMI undergoing TP decreased from 3.7% to 0.7% ($p < 0.00001$). No significant difference was found with regard to the indications for TP except for patients with posterior AMI complicated with a third degree atrioventricular block in whom a higher rate of TP was found (85%) compared with the 1986 results (56%) ($p < 0.05$).

CONCLUSION: The proportion of hospitals with TP facilities has nearly doubled since 1986. Over the same time period, the number of Danes undergoing TP in association with AMI was reduced. At present, TP is being performed in less than 1% of AMI patients.

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Data on temporary pacemaker treatment in Denmark in 1986 has previously been published [1]. The article was based on a questionnaire sent to all Danish hospitals treating patients with acute myocardial infarction (AMI). Since 1986, the number of hospitals in Denmark has been halved, and coronary reperfusion therapy has become the standard treatment of AMI. In the light of this development, the aim of the present study was: 1) to investigate current use of temporary pacing (TP) in Danish hospitals, and 2) to compare the updated results with the 1986 observations.

MATERIAL AND METHODS

In February 2010, a questionnaire was sent to 39 Danish hospitals receiving and treating patients with AMI. Hos-

pitals without these services were excluded. Three weeks later, a reminder was sent to hospitals that had not yet responded. The questionnaire included a total of ten questions and was identical to the questionnaire used in 1986 [1]. In the 2010 questionnaire, we asked for data from 2008 in order to optimize the likelihood that a complete data set was available. A similar strategy was used in the 1986 study. The first eight questions could be answered with one or more checkmarks. The two final questions were case stories with four alternative courses meant to illustrate the indications for TP in AMI [1].

The answers were compared with the answers from the 1986 study. We tested the null hypothesis: that there was no difference in the indications for TP in AMI between 1986 and 2008. The χ^2 -test was used, and a p value < 0.05 was considered statistically significant.

Trial registration: not relevant.

RESULTS

The questionnaire was returned by 33 of 39 (85%) hospitals (**Table 1**). Our data revealed that 31 hospitals (94%) had access to TP. In all cases, transcutaneous TP was an option, and in 20 hospitals (61%) facilities to perform transvenous TP were present. Two hospitals (6%) had no facilities for TP. Transcutaneous pacing was the mode of choice in five hospitals that offered access to both methods, whereas 15 hospitals initially would use transvenous TP. The preferred vein for transvenous TP was a central vein (subclavian or jugular) in 15 hospitals. An ante-cubital vein was the first choice in four hospitals, while one hospital preferred a femoral access. The pace electrode was placed by a cardiologist in 15 hospitals and as a result of a joint session between a cardiologist and an anaesthesiologist in three hospitals.

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 TABLE 1

Access to temporary pacemaker in Danish hospitals. The values are n (%).

	Total	Access to TP	Trans-cutaneous TP	Trans-venous TP	No access to TP
1986	74	39 (53)	13 (18)	33 (45)	35 (47)
2008	33	31 (94)	31 (94)	20 (61)	2 (6)

TP = temporary pacemaker.

In one hospital, a cardiologist and a physician from the department of internal medicine cooperated, and in one hospital a physician from the department of internal medicine did the transvenous procedure without assistance from other specialists.

Eighteen of 31 hospitals with facilities for TP answered questions 6-8 (Table 2). In these 18 hospitals, the total number of patients who underwent TP in 2008 was 479. The hospitals also provided the percentage of patients who had TP performed following AMI. Hence, a total of 67 patients in the 18 hospitals were treated with TP in association with AMI. The total number of patients with AMI in 2008 was 9,170 in the hospitals that answered this question. Thus, the proportion of patients who had an AMI requiring TP in 2008 was 0.7% ($(67/9,170) \times 100$), which was significantly lower than the proportion found in 1986 (3.7%) ($p < 0.0001$).

A total of 27 of the 31 hospitals answered the questions related to the two case stories, and all these hospitals had access to TP. Table 3 presents the results.



TABLE 2

The use of temporary pacemaker treatment after acute myocardial infarction in Denmark.

	Hospitals, n	AMI ^a , n	TP ^b , n	AMI and TP ^c , n	AMI and TP ^d , %
1986	31 (of 39)	8,095	486	300	3.7
2008	18 (of 31)	9,170	479	67	0.7

AMI = acute myocardial infarction; TP = temporary pacemaker.

- The total number of patients admitted with acute myocardial infarction.
- The total number of patients that underwent temporary pacemaker treatment.
- The hospitals were asked which percentage of their patients treated with temporary pacemaker had temporary pacemaker treatment performed because of acute myocardial infarction. From these data, the total number of patients treated with temporary pacemaker in association with acute myocardial infarction was calculated.
- The proportion of patients with acute myocardial infarction that was treated concomitantly with a temporary pacemaker.



TABLE 3

Indications for temporary pacemaker treatment. The values are n (%).

	Anterior AMI			Inferior AMI		
	1986 (n = 35 of 39)	2008 (n = 27 of 31)	p value ^a	1986 (n = 34 of 29)	2008 (n = 27 of 31)	p value ^a
Bifascicular block	3 (9)	1 (4)	0.44	–	–	
Trifascicular block	7 (20)	2 (7)	0.16	–	–	
Second-degree AV block, Mobitz II	20 (57)	17 (63)	0.64	9 (27)	13 (48)	0.08
Third-degree AV block, ventricular escape rhythm, 40 bpm	26 (74)	24 (89)	0.15	19 (56)	23 (85)	0.01

AMI = acute myocardial infarction; AV = atrioventricular.

a) χ^2 -test.

Ten hospitals added percutaneous coronary intervention (PCI) as a treatment option in case story A. In case story B, nine hospitals included PCI as part of their treatment. In three of the involved hospitals, PCI was reported as the only treatment.

Overall, no significant differences were found between the indications for TP used in 2008 and those used in 1986. The only exception from this was in inferior AMI with a third-degree atrioventricular (AV) block and a ventricular escape rhythm: 85% versus 56% ($p < 0.01$).

DISCUSSION

This study is the first to address potential changes in the pattern of TP over the past more than 20 years. The most striking result is that the proportion of hospitals with TP facilities has almost doubled since 1986. In the same time period, the total number of Danish hospitals was nearly halved (Table 1). The increased TP capacity results from a marked increase in the availability of external transcutaneous pacing (Zoll pacemakers) from 18% in 1986 to 94% in 2008. Another major observation from our data is that the placement of transvenous TP in 2008 was mainly being performed by cardiologists (95%). In 1986, clinical physiologists performed more than a third of the TP procedures.

According to the literature, the overall incidence of AV block after AMI is about 7% [2]. Third-degree AV block occurs in 5-15% of patients with AMI, while second-degree AV block Mobitz type II is reported in < 1% [3]. Development of conduction disturbances after an AMI is associated with an increased mortality. TP is a potential life-saving treatment that can support the heart and ensure sufficient perfusion in haemodynamically unstable patients. However, no randomized studies addressing the effect of TP on mortality in patients with AMI exist [4, 5]. The Danish Society of Cardiology (DCS) recommends that all hospital units receiving patients with acute cardiac disease should be able to perform transcutaneous TP [6]. Only two hospitals in our survey failed to meet these guidelines. The advantage of transcutaneous pacing is that the method is fast. However, if prolonged pacing is needed, transvenous TP should be preferred [5]. In case of a haemodynamically unstable patient, transcutaneous TP can be used as a bridge, while the patient is being transferred to another hospital for transvenous TP [5, 7, 8]. According to Danish health authorities, all hospitals with a main cardiology function should have on-site access to transvenous TP [9]. Among the hospitals participating in our study, 61% met this requirement in 2008 compared with 45% in 1986. Indeed, over time an improvement has occurred, but a discrepancy remains between the actual capacity to perform transvenous TP and the current recommendations.

Based on the literature, it is generally agreed that TP should be considered in haemodynamically unstable patients with bradycardia and/or intermittent asystole in association with AMI. [4]. An inferior AMI is often associated with a proximal conduction system above the bundle of His, a nodal escape rhythm with 45-60 bpm and a good response to medical treatment [3, 7]. TP is rarely required in inferior AMI [7]. Conversely, TP is often indicated in anterior AMI, which is typically associated with a distal conduction system under the bundle of His, a ventricular escape rhythm with 30-45 bpm and no response to medical treatment. The prognosis in anterior AMI is generally poorer than in inferior AMI due to more severe myocardial necrosis [2-3, 8].

In our study, no significant differences in the use of TP for anterior AMI in 2008 versus 1986 were found (Table 3). Patients with an inferior AMI and a third-degree AV block with a ventricular escape rhythm, however, showed a significantly higher TP rate in 2008. Also, a trend towards a more frequent use of TP in inferior AMI with second-degree AV block Mobitz type II was noticed. The reason for these partly contradictory observations is most likely multi-factorial: 1) The lack of evidence that TP in patients with large – and mainly anterior – AMIs can actually reduce mortality; 2) the advent and routinely use of newer treatment strategies in AMI including primary PCI within the period of more than 20 years between the two questionnaires; and, finally, 3) the fact that relatively more Danish hospitals had access to TP facilities in 2008 than in 1986. When comparing our observations with the recommendations from the American College of Cardiology/American Heart Association (ACC/AHA), Danish Hospitals appear to be rather reluctant in their use of TP. Indeed, the ACC/AHA recommends the application of transcutaneous pads and a standby transcutaneous pacing mode in both patients with bi- and trifascicular block and in patients with second degree AV block [5]. Actually, only 4% and 7% of Danish hospitals, respectively, would establish TP in patients with bi- and trifascicular block, while approximately half to two thirds of the hospitals involved would use TP in patients with inferior, respectively, anterior AMI if complicated with a second-degree AV block. It should be noticed, however, that our results are in accordance with the official recommendations from the DCS [10].

Since the publication of the DANAMI 2 results in 2003, primary PCI has been a routine treatment in patients with ST-elevation AMI [11]. Both case stories used in our questionnaires were constructed before the era of the ST-elevation and non-ST-elevation AMI terminology. Thus, the case stories were originally developed to illustrate the indications for TP in AMI in general. In 2008, the patients in the two case stories would most



Zoll pacemaker for external temporary pacemaker treatment.

likely be transferred directly to one of the five Heart Centres in Denmark in order to undergo primary PCI. Indeed, it can be argued that primary PCI should preferably have been included as a treatment option among the possible answers in both case stories. However, if we had done so, the questionnaires used in 1986 and in 2008 would not have been directly comparable. Indeed, a weakness of the recommendations from both the ACC/AHA and the Danish Society of Cardiology is that they are from the time before mechanical reperfusion therapy became routine treatment in AMI [5, 10]. After the introduction of primary PCI, it has been proposed that there is less need for TP owing to the reduction in the occurrence of AV block after ST elevation myocardial infarction (STEMI) [5]. Our data show that in 2008, TP was used in less than 1% of patients versus in 3.7% in 1986. This observation supports the hypothesis that fewer patients with AMI will need TP in the era of coronary revascularization therapy.

Study limitations

1) The preferred access for intravenous TP in both the 2008 and 1986 study was the subclavian or the internal jugular vein. However, in the questionnaire, the jugular vein was not a specified single option. Several hospitals chose to add jugular vein as an answer, while we had only proposed the subclavian vein as an alternative to extremity veins. This is a limitation of our study and may have caused some confusion over which was the pre-

ferred vascular access; 2) the participating hospitals were asked how many patients with AMI they had in 2008. Most hospitals gave estimates while only a minority reported the exact number of AMI admissions; 3) in 2008 transferral of AMI patients between hospitals was more frequent than in 1986. As a consequence, some patients may have been registered more than once and may thereby have falsely increased the frequency of AMI; 4) in 2008, a total of 479 AMI patients underwent TP in Denmark (transcutaneous and/or transvenous). Due to its invasive character, transvenous TP procedures are probably registered carefully at all hospitals. Transcutaneous pacing is a non-invasive procedure and was not necessarily registered in the same systematic way; 5) the percentage of participating hospitals was lower in 2008 (87%) than in 1986 (97%). The five hospitals that did not answer the 2008 questionnaire came from two of five Danish regions. No common denominator that would give rise to selection bias was observed. A potential cause for the reluctance to participate may be lack of time. One hospital replied that it lacked the necessary resources in terms of manpower to answer our questions; other hospitals may have been in the same situation.

CONCLUSION AND FUTURE PERSPECTIVES

Our data demonstrate a reduction in the use of TP after AMI over the past two decades. The main reason for this observation is most likely the implementation of reperfusion therapy including primary PCI as the standard treatment of acute STEMI. In the same time period, facilities for transcutaneous TP have become available at nearly all Danish hospitals treating patients with AMI. The present international guidelines for TP in AMI are from the time preceding the acute mechanical reperfusion era and an update is warranted.

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